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EXAMINER	
EHNE, CHARLES	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/779,378	LAND ET AL.	
	Examiner	Art Unit	
	Charles Ehne	2113	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-65 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-65 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1,4-10,16-21,24,27-33,39-44,45,48-54 and 60-65 are rejected under 35 U.S.C. 102(b) as being anticipated by Smith (6,347,359).

As to claim 1, Smith discloses a redundant array of inexpensive devices (RAID) comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices, a method for RAID conversion comprising:

storing in the controller one or more rules for selecting a desired one of the plurality of RAID algorithms based on one or more conditions of the array (columns 4-5, lines 66-9);

detecting the one or more conditions of the array (column 6, lines 8-10);

selecting the desired RAID algorithm based on the detected conditions and the stored rules (column 6, lines 8-16); and

when the desired RAID algorithm is different from the RAID algorithm currently implemented in the array, converting the array from the currently implemented RAID algorithm to the desired RAID algorithm (column 6, lines 16-26).

As to claim 24, Smith discloses redundant array of inexpensive devices (RAID) system comprising:

a plurality of n storage devices for storing user data thereon (Figure 1.102, column 4, lines 15-19); and

a controller connected to the storage devices for controlling writing and reading data to and from the storage devices according to a RAID algorithm (Figure 1.106, columns 4-5, lines 66-9),

the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices (column 5, lines 6-9),

the controller further storing one or more rules for selecting a desired one of the plurality of RAID algorithms based on one or more conditions of the array (column 5, lines 1-6),

the controller having stored program instructions or a logic circuit operable to detect the one or more conditions of the array, to select the desired RAID algorithm based on the detected conditions and the stored rules, and when the desired RAID algorithm is different from the RAID algorithm currently implemented in the array, to convert the array from the currently implemented RAID algorithm to the desired RAID algorithm (column 5, lines 1-9 & column 6, lines 16-26).

As to claim 45, Smith discloses computer program product comprising a computer usable medium having a computer readable code embodied therein for controlling a redundant array of inexpensive devices (RAID), the RAID comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices, the computer program product comprising:

first computer readable program code configured to cause the controller to storing one or more rules for selecting a desired one of the plurality of RAID algorithms based on one or more conditions of the array (columns 4-5, lines 66-9);

second computer readable program code configured to cause the controller to detect the one or more conditions of the array (column 6, lines 8-10);

third computer readable program code configured to cause the controller to select the desired RAID algorithm based on the detected conditions and the stored rules (column 6, lines 8-16); and

fourth computer readable program code configured to cause the controller to, when the desired RAID algorithm is different from the RAID algorithm currently implemented in the array, convert the array from the currently implemented RAID algorithm to the desired RAID algorithm (column 5, lines 1-9 & column 6, lines 16-26).

As to claims 4,27 and 48, Smith discloses the method wherein the desired RAID has fewer storage devices storing user data than the currently implemented RAID (column 8, lines 19-21).

As to claims 5,28 and 49, Smith discloses the method wherein the desired RAID has more storage devices storing user data than the currently implemented RAID (column 6, lines 33-35).

As to claims 6,29 and 50, Smith discloses the method wherein the conditions include the current capacity utilization of the array (column 5, lines 18-22).

As to claims 7,30 and 51, Smith discloses the method wherein the conditions include a performance requirement (column 6, lines 4-7, RAID 0 provides the best performance).

As to claims 8,31 and 52, Smith discloses the method wherein the conditions include a change in the number of available storage devices in the array (column 4, lines 57-62).

As to claims 9,32 and 53, Smith discloses the method wherein the conditions include a decrease in the number of available storage devices in the array (column 4, lines 57-62).

As to claims 10,33 and 54, Smith discloses the method wherein the conditions include an increase in the number of available storage devices in the array (column 4, lines 57-62).

As to claims 16,39 and 60, Smith discloses the method wherein at least some of the RAID algorithms stored in the controller are characterized by a number of storage devices in the array (n), and a device-loss insurance level (m) such that when up to m devices of the array are unavailable, user data is fully recoverable from the remaining $n-m$ devices, where $1 \leq m < n$, and wherein the selecting step determines desired n and m

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values based on the detected conditions and the stored rules (columns 1-2, lines 33-20 & column 3, lines 9-13).

As to claims 17,40 and 61, Smith discloses the method wherein the device-loss insurance level of the desired RAID is greater than the device-loss insurance level of the currently implemented RAID (column 6, lines 33-35).

As to claims 18,41 and 62, Smith discloses the method wherein the device-loss insurance level of the desired RAID is less than the device-loss insurance level of the currently implemented RAID (column 8, lines 19-21).

As to claims 19,42 and 63, Smith discloses the method wherein the condition is a decrease in the number of available storage devices in the array and the desired RAID after conversion has the same device-loss insurance level as the currently implemented RAID (columns 7-8, lines 67-7).

As to claims 20,43 and 64, Smith discloses the method wherein the condition is a decrease in the number of available storage devices in the array and the desired RAID after conversion has a lower device-loss insurance level than the currently implemented RAID (column 8, lines 19-21).

As to claims 21,44 and 65, Smith discloses the method wherein the rules define a maximum device-loss insurance level and a minimum device-loss insurance level for a given n value, and one or more conditions based on which a desired device-loss insurance level is determined, the desired device-loss insurance level falling between the maximum and minimum device-loss insurance levels (Figure 2, columns 1-2, lines

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33-20).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 2,3,22,23,25,26,46 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith taken in view of Uysal (6,922,752).

As to claims 2,25 and 46, Smith discloses the method wherein the converting step comprises:

(a) reading a unit of user data from the storage devices according to the currently implemented RAID algorithm (column 3, lines 9-14); and

(c) writing user data on appropriate storage devices according to the desired RAID algorithm (column 3, lines 9-14).

Smith fails to disclose the step (b) defining a watermark indicating the position where the data is read from the current RAID.

Uysal discloses a computer storage system including a controller and a storage array (Abstract, lines 1-2). Uysal discloses reconstructing data to a spare storage disk (column 5, lines 58-62). Uysal does disclose step (b) defining a watermark indicating the position where the data is read from the current RAID (column 6, lines 1-2).

It would have been obvious to one of ordinary skill in this art at the time of invention by applicant to include Uysal's method of defining a watermark indicating the position where the data is read from the current raid with Smith's RAID conversion. A person of ordinary skill in the art would have been motivated to implement the watermark to keep track of the progress of the reconstruction and allow asynchronous reading and writing in the background (Uysal: column 6, lines 3-6).

As to claims 3,26 and 47, Uysal discloses the method further comprising: alternating between performing steps (a), (b) and (c), and processing user I/O requests (column 6, lines 3-5).

As to claim 22, Smith discloses a redundant array of inexpensive devices (RAID) comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices, wherein at least some of the RAID

algorithms are characterized by a number of storage devices in the array (n), and a device-loss insurance level (m) such that when up to m devices of the array are unavailable, user data is fully recoverable from the remaining $n-m$ devices, where $1 \leq m < n$, a RAID conversion method comprising:

implementing a first RAID algorithm on the array (column 4, lines 15-38);

selecting a second RAID algorithm characterized by a number of storage devices n_2 and a device-loss insurance level m_2 , n_2 and m_2 being selectable (column 5, lines 1-9);

and converting the array from the first RAID algorithm to the second RAID algorithm, the converting step comprising:

(a) reading a unit of user data from the storage devices according to the first RAID algorithm (column 3, lines 9-14); and

(c) writing user data on appropriate storage devices according to the second RAID algorithm (column 3, lines 9-14).

Smith fails to disclose the step (b) defining a watermark indicating the position where the data is read from the current RAID.

Uysal discloses a computer storage system including a controller and a storage array (Abstract, lines 1-2). Uysal discloses reconstructing data to a spare storage disk (column 5, lines 58-62). Uysal does disclose step (b) defining a watermark indicating the position where the data is read from the current RAID (column 6, lines 1-2).

It would have been obvious to one of ordinary skill in this art at the time of invention by applicant to include Uysal's method of defining a watermark indicating the

position where the data is read from the current raid with Smith's RAID conversion. A person of ordinary skill in the art would have been motivated to implement the watermark to keep track of the progress of the reconstruction and allow asynchronous reading and writing in the background (Uysal: column 6, lines 3-6).

As to claims 23, Smith discloses the method of claim 22, wherein the writing step includes writing updates to a semi-permanent cache (column 4, lines 35-38).

Claims 11,12,34,35,55 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith taken in view of Anderson (2002/0059539).

As to claims 11,34 and 55, Smith discloses a method for RAID conversion comprising a redundant array of inexpensive devices (RAID) comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices, storing in the controller one or more rules for selecting a desired one of the plurality of RAID algorithms based on one or more conditions of the array (see claim 1 rejection). Smith fails to disclose wherein the conditions include a measure of data criticality of the user data.

Anderson discloses a data reconstruction system for a data storage device (Abstract, lines 1-2). Anderson does disclose wherein the conditions include a measure of data criticality of the user data (Page 1, ¶ 0014).

It would have been obvious to one of ordinary skill in this art at the time of invention by applicant to include Anderson's condition of a measure of criticality of the

user data with Smith's current conditions. A person of ordinary skill in the art would have been motivated to include the condition of criticality because this allows the users more critical data to have a higher degree of redundancy (Anderson: Page 1, ¶0014, lines 3-5).

As to claims 12,35 and 56, Smith discloses a method for RAID conversion comprising a redundant array of inexpensive devices (RAID) comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices, storing in the controller one or more rules for selecting a desired one of the plurality of RAID algorithms based on one or more conditions of the array (see claim 1 rejection). Smith fails to disclose wherein the conditions include a measure of recency and repetition of the user data.

Anderson discloses a data reconstruction system for a data storage device (Abstract, lines 1-2). Anderson does disclose wherein the conditions include a measure of recency and repetition of the user data (Page 15, ¶ 0196, lines 1-3).

It would have been obvious to one of ordinary skill in this art at the time of invention by applicant to include Anderson's condition of a measure of recency and repetition of the user data with Smith's current conditions. A person of ordinary skill in the art would have been motivated to include the condition criticality because this allows the users more critical data to have a higher degree of redundancy (Anderson: Page 1, ¶0014, lines 3-5 & Page 15, ¶0195, lines 1-4).

Claims 13,36 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith taken in view of Belhadj (6,516,425).

As to claims 13,36 and 57, Smith discloses a method for RAID conversion comprising a redundant array of inexpensive devices (RAID) comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices, storing in the controller one or more rules for selecting a desired one of the plurality of RAID algorithms based on one or more conditions of the array (see claim 1 rejection). Smith fails to disclose wherein the conditions include a measure of vulnerability of the storage devices.

Belhadj discloses a method of managing data in a hierarchical data storage system employing data redundancy schemes (Abstract, lines 1-4). Belhadj does disclose wherein the conditions include a measure of vulnerability of the storage devices (column 5, lines 40-45).

It would have been obvious to one of ordinary skill in this art at the time of invention by applicant to include Belhadj's condition of vulnerability of the storage device with Smith's current conditions. A person of ordinary skill in the art would have been motivated to include the condition of vulnerability because this minimizes the probability of data loss during a rebuild in a RAID system (Belhadj: column 5, lines 19-23).

Claims 14,15,37,38,58 and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Smith taken in view of Schultz (6,058,489).

As to claims 14,37 and 58, Smith discloses a method for RAID conversion comprising a redundant array of inexpensive devices (RAID) comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices (see claim 1 rejection). Smith fails to disclose wherein the converting step is performed on line.

Schultz discloses a system for performing reconfiguration of a disk array (Abstract, lines 1-2). Schultz does disclose wherein the converting step is performed on line (column 2, lines 41-43).

It would have been obvious to one of ordinary skill in this art at the time of invention by applicant to include Schultz's method of on line converting with Smith's RAID conversion. A person of ordinary skill in the art would have been motivated to include the step of converting on line because the data on the disk array would be still available to the user during the converting step (Schultz: column 2, lines 8-11).

As to claims 15,38 and 59, Smith discloses a method for RAID conversion comprising a redundant array of inexpensive devices (RAID) comprising a controller and a plurality of storage devices for storing user data, the controller storing a plurality of RAID algorithms to be implemented for writing data to and reading data from the storage devices (see claim 1 rejection). Smith fails to disclose wherein the converting step is performed off line.

Schultz discloses a system for performing reconfiguration of a disk array (Abstract, lines 1-2). Schultz does disclose wherein the converting step is performed off line (column 2, lines 2-3).

It would have been obvious to one of ordinary skill in this art at the time of invention by applicant to include Schultz's method of off line converting with Smith's RAID conversion. A person of ordinary skill in the art would have been motivated to include the step of converting off line because this allows for the reconfigure process to add new disk drives to form a larger logical volume (Schultz: columns 1-2, lines 66-2).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Charles Ehne whose telephone number is (571)-272-2471. The examiner can normally be reached on Monday-Friday 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Beausoliel can be reached on (571)-272-3645. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Robert H. Beauchamp, Jr.
PATENT EXAMINER
ART UNIT 2100